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Study on the preparation of low-background flexible electronics substrate based on ion beam modification polymer surface

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The upgrading rare event detection experiments has become increasingly urgent with updating the performance of the electronics. In the next phase of China Dark Matter EXperiment (CDEX), the electronics have been designed barely immersing in 6.5 m shielding thickness of liquid nitrogen with detector crystal, and the flexible electronic substrate (FES) composed electronics are required to be high adhesion, low-temperature resistance and low-background. Polytetrafluoroethylene (PTFE) is widely recognized with low-background, high dielectric properties. To solve the problem of poor surface adhesion, we propose a new method for analyzing the surface adhesion of polymers, which provide direct insight into the influence of ion implantation on the polymer surface adhesion. The adhesion of self-developed FES after soaked in liquid nitrogen for 20 days is not less than 0.67 N/mm, demonstrating good low-temperature resistance. In addition, the dissipation factor of the self-developed FES is less than 0.003 at 173K, which is better than 17 times that of commercial FES products. Furthermore, the screened low-background PTFE and PTFE composite films can be designed as CDEX partition materials. In conclusion, we studied the structure-activity relationship of ion implantation modification polymer surfaces, which provides a theoretical basis and practical example for the development of high adhesion, low-temperature resistance and low-background FES.

Submitted on behalf of a Collaboration?

No

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